LA-UR-22-22500

Approved for public release; distribution is unlimited.

Title: FY23 Omega-60 Mshock Shot Request

Author(s): Flippo, Kirk Adler
Merritt, Elizabeth Catherine
Rasmus, Alexander Martin
Doss, Forrest William
Di Stefano, Carlos
Sacks, Ryan Foster

Intended for: Shot request to external facility scheduling committee

Issued: 2022-03-16

FY23 Omega-60 Mshock Shot Request

K. A. Flippo, E.C. Merritt, A. Rasmus,
F. Doss, C. Di Stefano, R. Sacks

MShock provides platform & diagnostic development in support of both regular and heat-flux influenced mixing studies

- **Purpose**:
  - Evaluate the effects of controlled heat flux on the evolution of a KH mixing layer (well-developed mixing platform)
  - Continue development of a defect-driven jet platform

- **Motivation**:
  - Heating of the mixing layer has been theorized to significantly alter instability growth by changing the density gradient in the mixing region. Energy deposition (such as pre-heat) could affect simulations of mix in ICF capsules since different materials can experience significantly different heating. For example, in multi-shell capsules with both low- and high-Z layers.
    - *We would like to examine the effect of heat deposition on the mixing layer, i.e. heat fluxes either into or out of the layer*
    - We can vary heat flux magnitude and direction into or out of the mixing layer by varying the layer and foam materials (relative opacity to the x-ray spectrum) while preserving the other hydrodynamic properties of the system
    - If initial studies are promising, these experiments will form the basis for similar studies on NIF which has significantly longer KH development times and has shown the hallmarks of a transition to turbulence
  - Improve our defect-driven jet platform to generate more developed & resolvable mixing structures to test the 2D vs 3D modelling capability of our xRAGE hydrocode
    - Builds on designs from FY19 but is no longer constrained in design by associated traditional fluid experiments
    - *Symmetric jet geometry is ideal for development of a multi-Fresnel zone plate (FZP) array for higher-resolution multi-frame imaging since we can get a direct comparison between pinhole and FZP images on the same shot (continued from FY21-FY22)*

- **Goals**:
  - **(Q2)** Complete heat-flux (or non-heated baseline) data sets from the FY22 shots and/or begin to flux magnitude study
  - **(Q4)** Vary defect specifications to vary jet evolution
  - **(optional)** Continue on-shot multi-frame FZP development

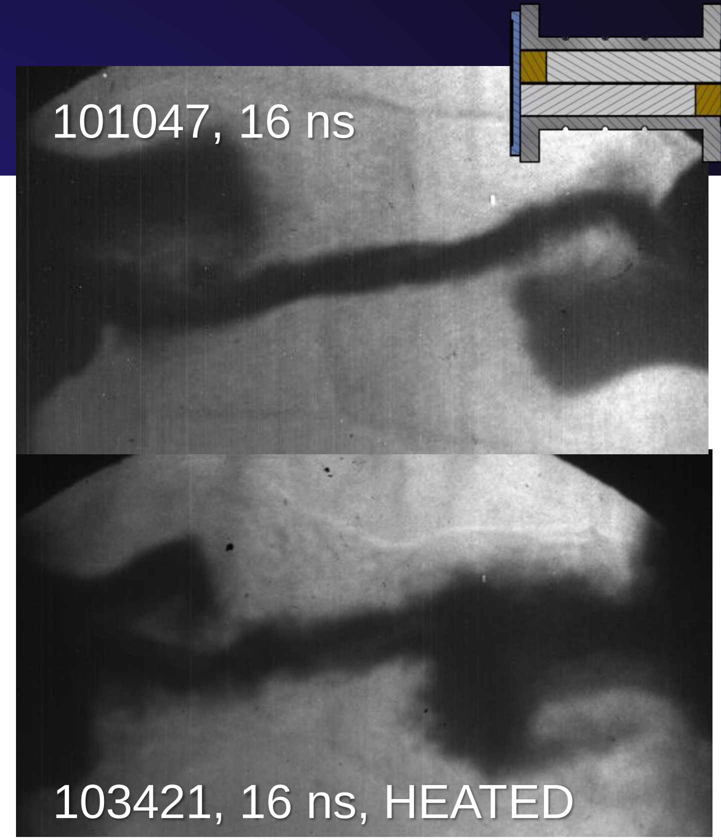
- **PI/Designer**: **K. A. Flippo, E. Merritt, A. Rasmus/ F. Doss, C. Di Stefano, R. Sacks**

Summary Shot Table	Q1FY23	Q2FY23	Q3FY23	Q4FY23
Total shots		*14*		*14*

In FY21-22 we demonstrated heated Shear and jet platform feasibility and completed initial data sets for our heat flux studies

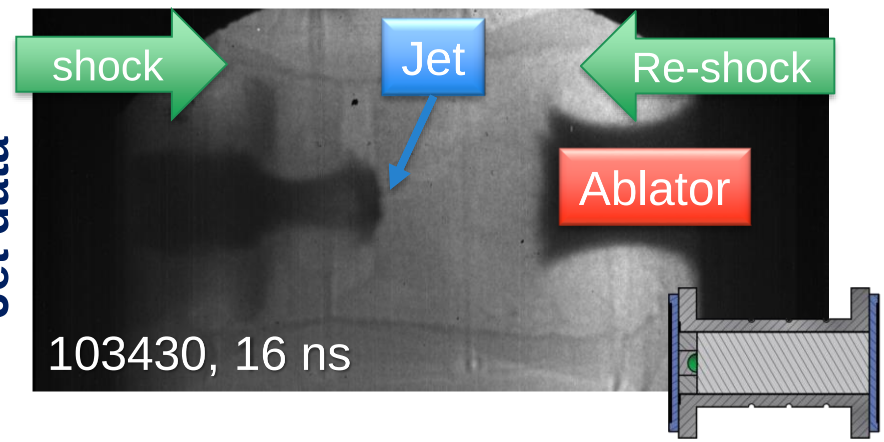
Between Mshock 21A & 22A we completed:
- Two (non-heated & heated) comparison data sets for the heat-flux out of the layer
- Heated data set for heat-flux across the layer
  - 22A used improved (more homogeneous) foam fabrication based on observations from first R&D attempts on 21A
  - Need non-heated and non-driven (pressure difference) comparison data with improved foams

Heated Shear data



Mshock 22A successfully prototyped a re-shocked, defect-driven jet experiment
- Modification of an R&D single-shock jet experiment on Mshock-20A which was dominated by the ablator signal, and showed minimal jet evolution

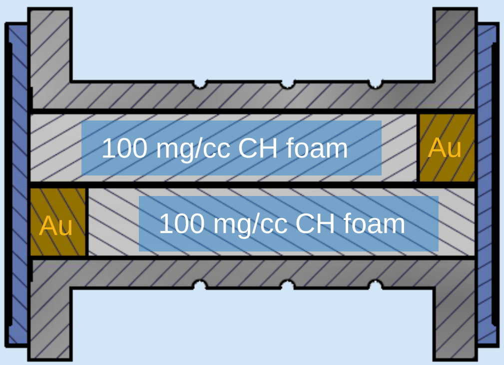
Jet data



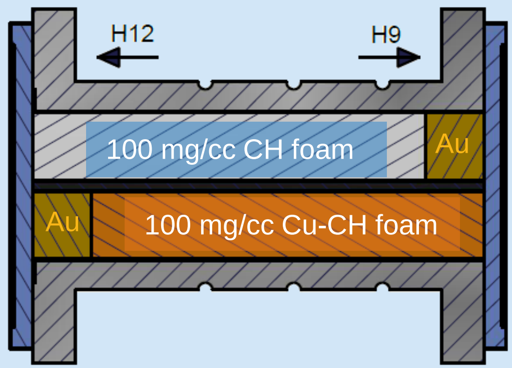
OMEGA Mshock-23: 2 target variations, and 2 laser setup variations

All three targets are a variation of our standard shock-tube target

Shear type target w/ heater foils

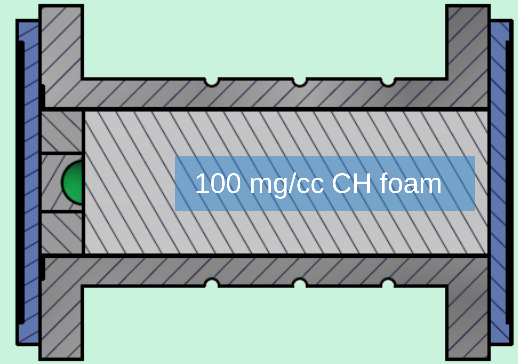


Type **ORANGE**
- Fe Layer
- 100 mg/cc CH foam
- Au plugs



Type **BLACK**
- Be Layer
- 100 mg/cc CH foam
- 100 mg/cc Cu-CH foam
- Au plugs

Defect-driven jet target



Type **Purple**
- Divot layer next to ablator (H12 side)
- Foam: 100 mg/cc HIPE
- Recessed Au (5 um) ablator
- 6 um Mn on Be BL on target TIM 6 side

Dual-drive + Heaters
- H12 Drive & H9 drive
- TIM6 BL & TIM2 BL
- Heater beams
  - (4 sets)

Dual-drive-only
- H12 Drive & H9 drive
- TIM6 BL & TIM2 BL

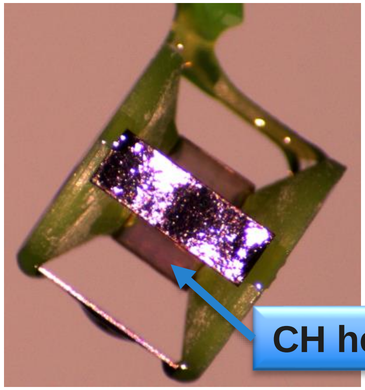
Laser setup variations are the same except for dropping beam groups

Dual-drive + Heaters

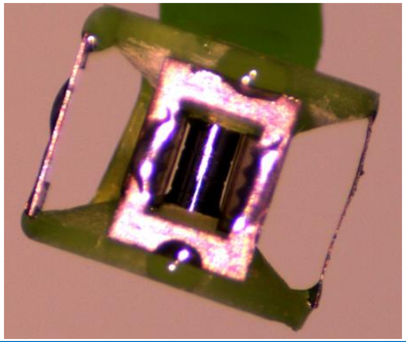
RID 84727

Will vary BL driver timings, and beams on or off

Nominal Main Target

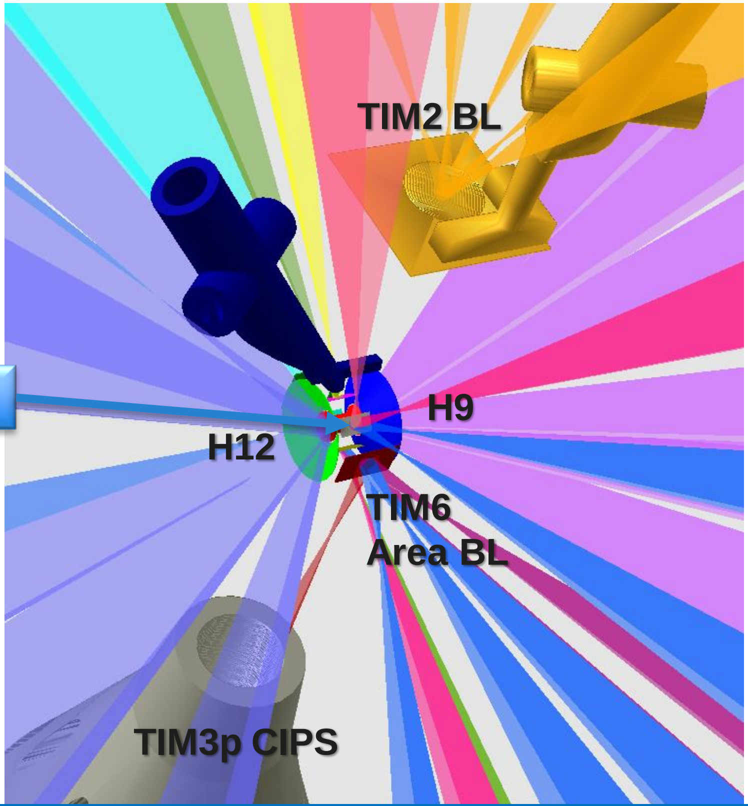


TIM6 view



TIM3p view

CH heater foil



TIM2 BL w/ current stalk design

E-300 DPP

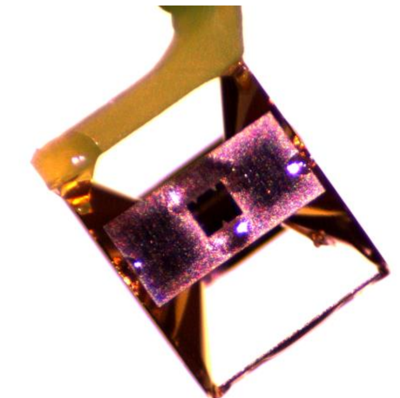
Purpose	Beams	Driver	Pulse Shape	R (um)	Pointing Theta (deg)	Phi (deg)	Focus (mm)	DPP	DPR
H12 Driver	11,13,14,18,32,66,67,69	SSD	1 ns sq	840	90	252	-0.5	Y	Y
H9 Driver	34,36,41,43,48,49,63,60	SSD	1 ns sq	840	90	72	-1.1	Y	Y
TIM 6 side BL	**50, 51, 53, 54, 57**	BL	1 ns sq	2170	Varies	varies	varies	N	N
TIM 2 BL	22,26,52,55,56,58	BL	1 ns sq	12500	26.58	162	-3	N	N
H13 Heaters	15,16,35,37,39	SSD	1 ns sq	1040	110	342	0	N	N
H1 Heaters	17,31,10	SSD	1 ns sq	1040	20	342	0	N	N
P12 Heaters	44,62,64	SSD	1 ns sq	1040	162	158	0	N	N
H8 Heaters	42,40,65,68	SSD	1 ns sq	1040	70	162	0	N	N

Dual-drive only

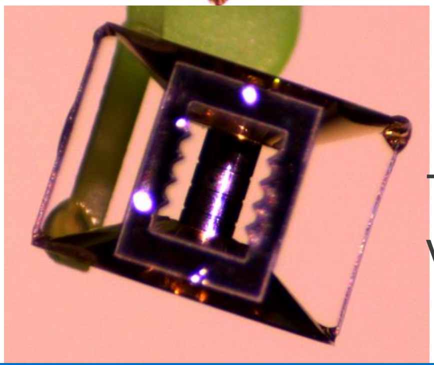
RID 84729

Will vary BL driver timings, and beams on or off

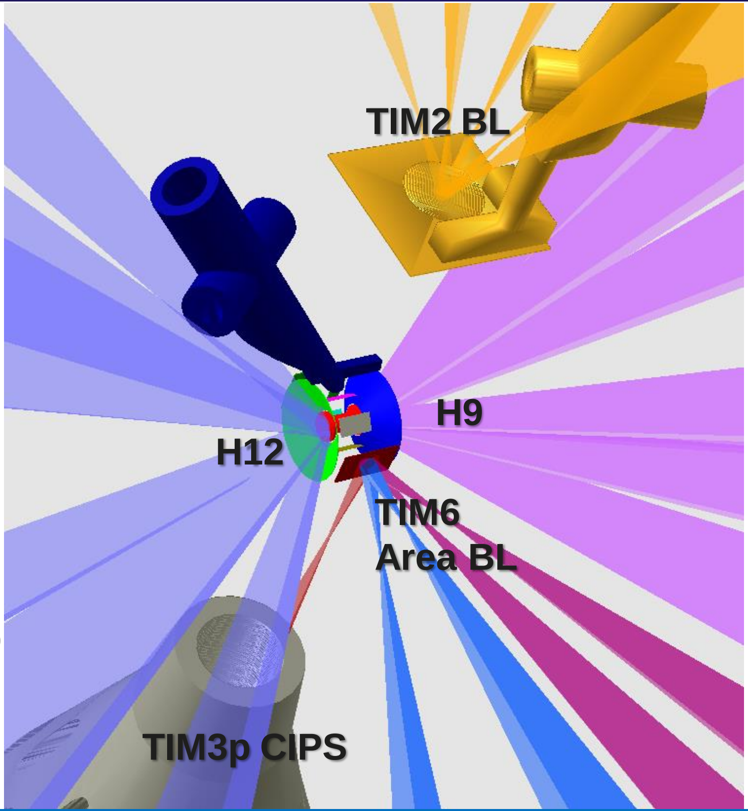
Nominal Main Target



TIM4 view



TIM3p view



TIM2 BL w/ current stalk design

E-300 DPP

Purpose	Beams	Driver	Pulse Shape	R (um)	Pointing Theta (deg)	Phi (deg)	Focus (mm)	DPP	DPR
H12 Driver	11,13,14,18,32,66,67,69	SSD	1 ns sq	840	90	252	-0.5	Y	Y
H9 Driver	34,36,41,43,48,49,63,60	SSD	1 ns sq	840	90	72	-1.1	Y	Y
TIM 6 side BL	**50, 51, 53, 54, 57**	BL	1 ns sq	2170	Varies	varies	varies	N	N
TIM 2 BL	22,26,52,55,56,58	BL	1 ns sq	12500	26.58	162	-3	N	N
~~**H13 Heaters**~~	~~15,16,35,37,39~~	~~SSD~~	~~1 ns sq~~	~~1040~~	~~110~~	~~342~~	~~0~~	~~N~~	~~N~~
~~**H1 Heaters**~~	~~17,31,10~~	~~SSD~~	~~1 ns sq~~	~~1040~~	~~20~~	~~342~~	~~0~~	~~N~~	~~N~~
~~**P12 Heaters**~~	~~44,62,64~~	~~SSD~~	~~1 ns sq~~	~~1040~~	~~162~~	~~158~~	~~0~~	~~N~~	~~N~~
~~**H8 Heaters**~~	~~42,40,65,68~~	~~SSD~~	~~1 ns sq~~	~~1040~~	~~70~~	~~162~~	~~0~~	~~N~~	~~N~~

Diagnostics

TIM

Port	Diagnostic	Priority
TIM 1	XRPHC 1	Secondary
TIM 2	**TTP**	**Primary**
TIM 3	**XRFC, CIPS_6X-6mm ~25X**	**Primary**
TIM 4	**XRFC, pinhole array w/ or w/o FZPs**	Primary
TIM 5	XRPHC 5	Secondary
TIM 6	PJX2, SXS	Secondary

Fixed

Port	Diagnostic	Priority
H12C	XR Pinhole Camera H12 (XRPHC)	Secondary
H13C	XR Pinhole Camera H13 (XRPHC)	Secondary
H4F	XR Pinhole Camera H4 (XRPHC)	Secondary
H8C	XR Pinhole Camera H8 (XRPHC)	Secondary
P2C	XR Pinhole Camera P2 (XRPHC)	Secondary